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Notes on Lycoperdon sculptum Harkness

William Albert Setchell

(WITH PLATE 20)

The large puffball of the Sierra Nevada Mountains of California was first made known in 1885 by Dr. H. W. Harkness, in the first volume of the Bulletin of the California Academy of Sciences (page 160), with the general statement that it is "found only at considerable elevations, 6,000 to 8,000 feet in the Sierra Nevadas." In conversation several years since, Dr. Harkness told me that the original specimens came from some locality on the eastern slopes, but he seemed uncertain as to the exact locality. At that time, the "Harkness Collection of Fungi," which had been given to the Academy, was not in order and I was unable to make any search. The type, however, was preserved as a museum specimen under glass with no data accompanying it. After the death of Harkness, the collection was placed in order by Miss Alice Eastwood, curator of the herbarium and I made an examination of all the specimens of this species contained in it with notes as to my results. I found only one specimen with the locality marked and that came from near Summit in Placer County, at an altitude of about 6,700 feet. This is probably, then, to be considered as the type locality.

In the herbarium of the University of California, there are several good specimens of this species and with satisfactory data. One came from Summit, our supposed type locality, where it was collected by Mrs. Charles H. Shinn. One of the earliest specimens to be received at the University was collected by Mr. D. T. Fowler, in Sierra Valley, in Sierra County, at an altitude estimated by him to be about 4,800 feet. He also reports finding several specimens along the road between Sierra Valley and Truckee. These collections were reported by J. Burtt Davy in the "Reports of the work of the Agricultural Experiment Station of the University of California for the years 1898–1901" (page 353), under the name of *L. insculptum* (error in copying). Several specimens in perfectly ripe condition were collected by C. C. Dobie and myself in the neighborhood of Emerald Bay, Lake Tahoe, at about 6,500 feet in 1901. They were so mature that they fell to pieces during transportation to Berkeley. There is a specimen, somewhat immature, collected by H. N. Bagley in June, 1902, at Tamarack Flat, on the Big Oak Flat Road in Mariposa County, at an altitude of 6,400 feet. Finally there have recently been added to the herbarium specimens collected by Dr. H. M. Hall, at Bluff Lake in the San Bernardino Mountains in July, 1908, at an altitude of 8,300 feet. Besides these specimens in the herbarium of the University of California, there are a few in other collections known to me. Lloyd mentions in his Mycological Notes (No. 18, page 203, 1904) that he had received a specimen from Professor W. C. Blasdale collected near Lake Tahoe and that there is in the herbarium at Kew, some ripe gleba sent by Harkness. The specimens of Harkness were destroyed in the fire of April, 1906, which destroyed as well the buildings and most of the collections of the California Academy of Sciences. I learn from Mr. S. B. Parish of San Bernardino, that he also collected a specimen at Bluff Lake, the same locality whence Dr. Hall procured his specimens, and sent it to the late A. P. Morgan, in whose collection I presume that it may still be found. These are all the collections known to me.

In 1906, I published in the Sierra Club Bulletin (**6**: 39) a popular description of this puffball under the title of "The Sierran Puffball" and illustrated it with photographs. It was really an appeal to members of the Sierra Club to note the occurrence and report localities and altitudes at which they might find it. As a response, several members of the Club have told me of specimens seen and with sufficiently definite information as to appearance to make it reasonably certain that it was this and no other species observed. This information, with an item received before the publication of the article, I append as hearsay, but none the less, credible evidence as to range in latitude and altitude. The late Professor J. J. B. Argenti, of San Francisco, evidently found it at Crane Flat, on the Big Oak Flat Road, at an altitude of 6,300 feet. Professor C. B. Bradley, of Berkeley, reports it from the head of Bear Valley, in Alpine County, at an altitude of 6,500 feet. He found it in 1895. Mr. H. O. Wood, of Berkeley, reports it from above Lake Tenaya, in Mariposa County, at an altitude of between 8,200 and 8,300 feet. Mr. William E. Colby, of San Francisco, Secretary of the Sierra Club, found it in the Tuolumne Meadows, at about 8,500 feet and, tasting the raw flesh, found it to be very agreeable in flavor. Mrs. Katherine Brandegee, of Berkeley, saw some specimens collected by others in the Giant Forest of the Sequoia National Park, at an altitude of about 6,500 feet.

From the evidence given above, it seems well ascertained that the distribution of *Lycoperdon sculptum* extends at least from Sierra Valley on the north, down along the Sierra Nevada and San Bernardino Mountains to Bluff Lake and that in altitude, it ranges from 4,800 feet up to 8,500 feet. The striking range as regards altitude, as well as the extraordinary markings of this species may well make one wonder as to whether it is likely to be retained in *Lycoperdon* or one of its segregates, or made the type of a distinct genus. While I do not intend to attempt to settle this question, it seems desirable to add some description of the species drawn from both the living and the dried specimens.

So far as I may learn, *Lycoperdon sculptum* is most usually found in alluvial soil and often among the willows which border small streams, but it is also found in the drier soil under pines and perhaps also under *Sequoia gigantea*. As I found it myself, there were nearly a dozen specimens in the same small area, but often single specimens are found with no others near them. They are fairly conspicuous objects up to the time that the peridium falls away and exposes the spores. The peridium retains its light color until maturity.

The shape of a well-developed specimen is that of a pear, somewhat, or even considerably, flattened laterally. The size varies from about 10 to 20 cm. in the longest horizontal diameter and the plants reach a height of 10 to 15 cm. The sterile base of the puffball is stout, usually buried in the ground, and it has the remnants of stout mycelial strands at its very base. This is well represented in the upper and left middle specimens in the photograph reproduced in connection with this paper. The upper portion of the puffball is sometimes nearly globular, but is generally very decidedly flattened laterally and has the outer peridium broken up into coarse pyramidal areas which surpass in size, especially in height, those of any known puffball, unless it may be such species as those of *Phellorina* or *Scleroderma strobilinum.* These pyramidal projections in *Lycoperdon sculptum* are well represented in the right middle specimen in the accompanying plate, which, however, is reduced to one half the proper diameter. They are often as much as 3.5 cm. in basal diameter and reach a height of 3 cm.; they taper to a more or less sharp apex, which is generally incurved, and are marked with horizontal lines, representing the layers of the thick outer peridium. They are reasonably well shown in the original figure of Harkness (*loc. cit.*) but do not show very well in the figure given by Lloyd (*loc. cit.* 203. *f. 81*). They remain persistent until the final breaking up of the whole peridium, not in any way appearing to be evanescent or caducous.

Many specimens of *Lycoperdon sculptum* are affected by the attacks of insects or by dry conditions, or some other influence, so that they do not develop beyond a certain stage, such as is represented in the two lowermost figures in the photograph which accompanies this paper. They become somewhat mummified and in this condition are easily transported and preserved. They show fairly well the main external characters of the projections, but do not reach the normal size or attain the normal shape. The specimen figured by Lloyd (*loc. cit.*) seems to be one of this sort. Such specimens well represent stages in development, but not the typical adult plant.

The gleba, in well-developed specimens, is white at first, later turning yellowish, then an intense yellow and finally a decided umber, as the spores ripen. It is early readily separable from the peridium and from the tissues of the stipe. The spores are rough and about 2–3.5 μ in diameter, light yellowish and nearly smooth when young, becoming dark and slightly but evenly warted when mature. Harkness, and all who follow him, say that the spores are smooth, and young spores, which, judging from the descriptions of the color of the gleba ("yellow") are all that they have had to examine, appear smooth, but, in the really mature glebae which I have, the spores are plainly rough even with ordinary high powers, while with the one-twelfth inch oil-immersion, the regular warted character is plainly to be seen. The size of the spores is the same in all the mature specimens that I have been able to examine and differs from that as given by Harkness, viz., "5–8 μ," in that the average runs from 2 μ to 3.5 μ. Occasionally a larger spore is seen, but I have not been able to obtain any measurements approaching those of Harkness. The capillitium threads, in the really matured specimens, are thick-walled and of the same color as the spores. They are short and very seldom show any branching at all. For the most part, the ends appear broken, but in some cases they are rounded.

I have chosen to use the name for this species which was given to it by Harkness. There seems to be no definite agreement as yet as to just how and upon what characters the genus *Lycoperdon* shall be segregated. In the matter of dehiscence, however, it does not belong to that section of the genus whose members open by means of an apical pore, but rather to that section in which the peridium breaks up into plates which, falling off, gradually expose the whole ripened gleba. This brings the species into the genus *Calvatia* in the sense in which it is used by some authors. It is also "stipitate," and this may be another reason for considering it to belong to this genus, should it be decided to keep it distinct. It has already been referred to *Calvatia* by Lloyd (*loc. cit.*, under "*Calvatia sculptum*"). As to its relation to the genus *Areolaria*, or as to its being the type of a new genus, I have very little to say, except that I agree with Lloyd that its nearest relative seems to be *Lycoperdon caelatum* Bull., which is also referred to *Calvatia*.

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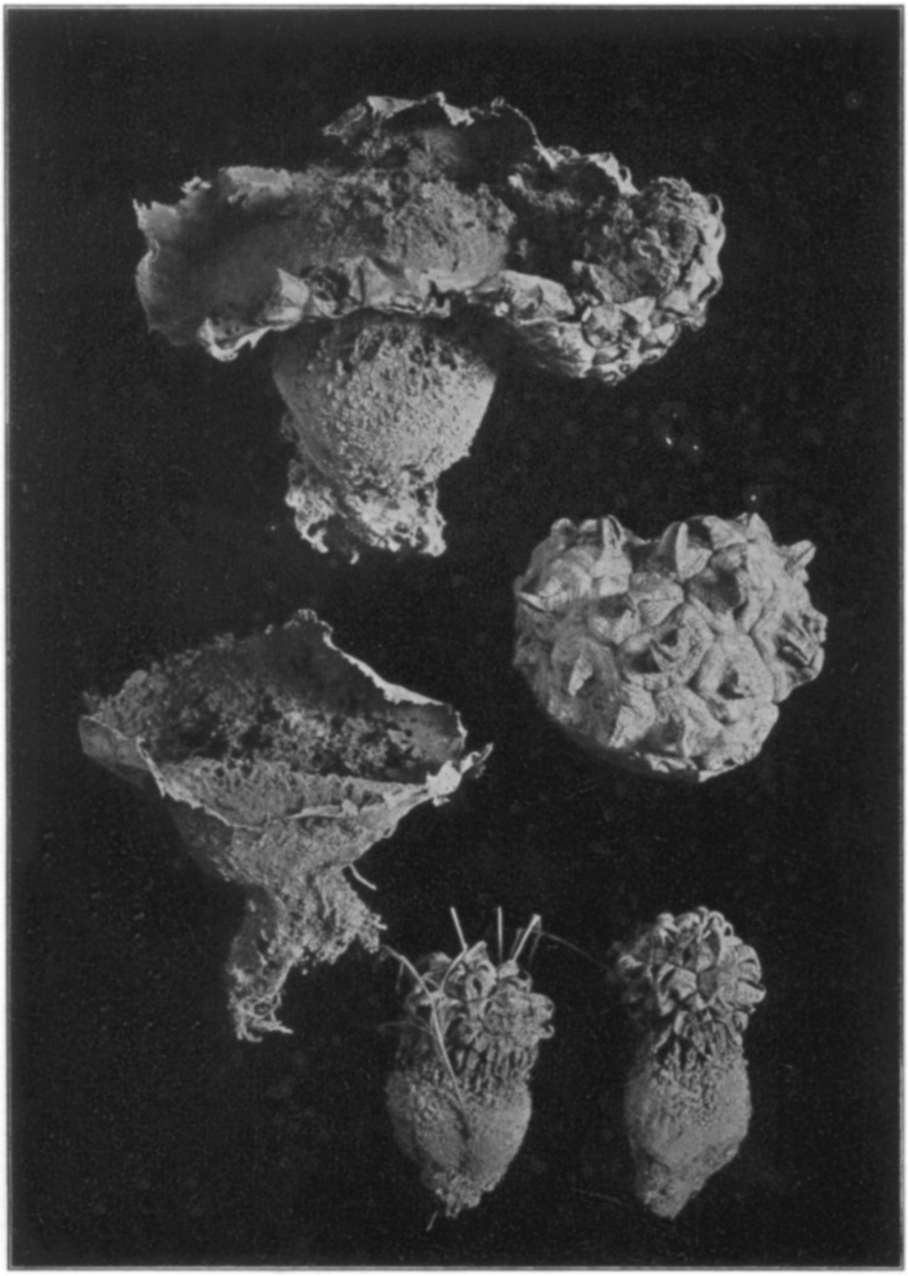
Explanation of plate 20

The uppermost figure represents a mature specimen which has lost most of the peridium and gleba, while the left middle figure represents one which has lost all of the upper portion and is reduced to the sterile "stipe." The two lowermost figures show mummified young specimens. All the four specimens just mentioned were collected by C. C. Dobie and myself near Emerald Bay, Lake Tahoe, California, and are preserved in the herbarium of the University of California.

The right middle figure represents a portion of the peridium of a mature specimen, seen from above. It was collected in Sierra Valley, California, by D. T. Fowler, and is in the herbarium of the University of California.

All the figures were photographed and are reproduced at one half the diameter of the original specimens.



LYCOPERDON SCULPTUM Harkness